RHODORA, Vol. 92, No. 871, pp. 129–141, 1990

ASTER ANTICOSTENSIS, AN ENDEMIC OF NORTHEASTERN NORTH AMERICA: BIOLOGY AND CONSERVATION

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ABSTRACT

Aster anticostensis is endemic to the Baie des Chaleurs (Gaspé), Anticosti Island, and the Saint John and Aroostook River basins (Quebec–New Brunswick–Maine). It was long confused with *A. novi-belgii.* It is found in the geolittoral zone along fast-flowing rivers. Eight sites are known, five of which were rediscovered in 1988. The species is rare throughout its range, but it has a more precarious status (endangered) in New Brunswick and Maine, where the taxon is reported here for the first time. Disturbances of the river banks as a result of human activity and regulation of water flow due to dam construction are the main factors threatening survival of this plant.

Key Words: *Aster anticostensis, Compositae,* endemic, conservation, Quebec, New Brunswick, Maine

INTRODUCTION

Aster anticostensis Fernald is a species endemic to northeastern North America; it has long been confused with *A. novi-belgii* L. With the latter it belongs in section *Dumosi,* subsection *Foliacei,* characterized by a basic chromosome number of x = 8 and foliaceous phyllaries (Semple and Brouillet, 1980). The epithet *anticostensis* was applied only to the type collection. According to Fernald (1950), the other Asters reported under this name (e.g., Marie-Victorin and Rolland-Germain, 1969) do not correspond to the type description. Re-location of the taxon and determination of its chromosome number, under the name *A. gaspensis* Marie-Victorin, have been reported by Brouillet and Labrecque (1987). The nomenclatural history was discussed in detail in that paper and is summarized here in Table 1.

According to Brouillet and Labrecque (1987), *Aster anticostensis* is an allopolyploid derivative of *A. borealis* (T. & G.) Prov. and *A. novi-belgii.* Following this hypothesis, *A. anticostensis* would have an eastern origin and thus would not represent a disjunct, cordilleran taxon as suggested by Fernald (1915) and Marie-Victorin (1932).

Table 1. Taxonomic treatment of *Aster anticostensis* Fernald.

Fernald, 1915	*A. anticostensis* Fernald
Marie-Victorin, 1932	*A. gaspensis* Marie-Victorin
Fernald, 1950	*A. johannensis* p.p.
	A. anticostensis Fernald
Cronquist, 1952	*A. gaspensis* Marie-Victorin
Cronquist, 1958	*A. johannensis* Fernald
Boivin, 1966	*A. novi-belgii* L. var. *villicaulis* (Gray) Boivin
Boivin, 1972	*A. hesperius* Gray var. *gaspensis* (Vict.) Boivin
Scoggan, 1979	*A. novi-belgii* L. var. *novi-belgii*

METHODS

Previously known populations of *Aster anticostensis* were researched in August of 1988; the main biotic and abiotic characteristics of the habitats of these populations were noted (Table 2), as well as the status, area and density of the populations. The types of *A. anticostensis* (GH) and *A. gaspensis* (MT) were compared to determine correct nomenclature of the plants examined in the field. Specimens of this and related taxa were examined in CAN, DAO, GH, ISC, MO, MT, NEBC, NY, TRT, UNB, WAT and WIS.

DISTRIBUTION

Aster anticostensis has been found only on Anticosti Island, in the Baie des Chaleurs (Gaspé) and in the Saint John and Aroostook River basins (Figure 1). This is the first report of this species for New Brunswick and for the U.S.A. (Maine). Although the taxon was collected earlier, it was incorrectly identified. Some specimens in the Gray Herbarium from Lake Mistassini and the James Bay region were identified as *A. gaspensis* by Cronquist (1947). Upon examination, it was found that these individuals belong to *A.* "*longifolius*" (*sensu* Semple and Heard, 1987) and not to *A. anticostensis*.

HABITAT

Except for the type locality on Anticosti Island, the range of distribution of *Aster anticostensis* lies within the 2250–2500 degree-day zone; i.e., the Baie des Chaleurs and Saint John River valley (Rousseau, 1974). The northern limits of several taxa, such

Table 2. Main habitat parameters and status of populations of *Aster anticostensis* as observed in 1988.

Population	Slope	Substrate	% Surface Rock	Drainage	Population Size	Number of Individuals
Somerville (N.B.)	3–5%	gravel	98	good	3 individuals over a distance of 100 m.	3
Matapédia	5%	calcareous gravel	95	good	approx. 1 km × 10 m	several thousand density about 1 ind/m²
Bonaventure	2–3%	calcareous gravel	95	good	1 km × 10 m (300 m east side of the bridge, 700 m west side)	several thousand density about 0.5 ind/m²
Grande-Rivière	3%	gravel on slate	90	very good	approx. 1 km × 10 m	several thousand density about 1 ind/m²
Grande Rivière 2	1% concave	calcareous gravel	95–50	good	approx. 2 km × 10 m	several thousand density about 1 ind/m²
Petit-Pabos	2–3% eroded	calcareous gravel on sand	10	good	approx. 1 km × 10 m	several thousand density about 1 ind/m²

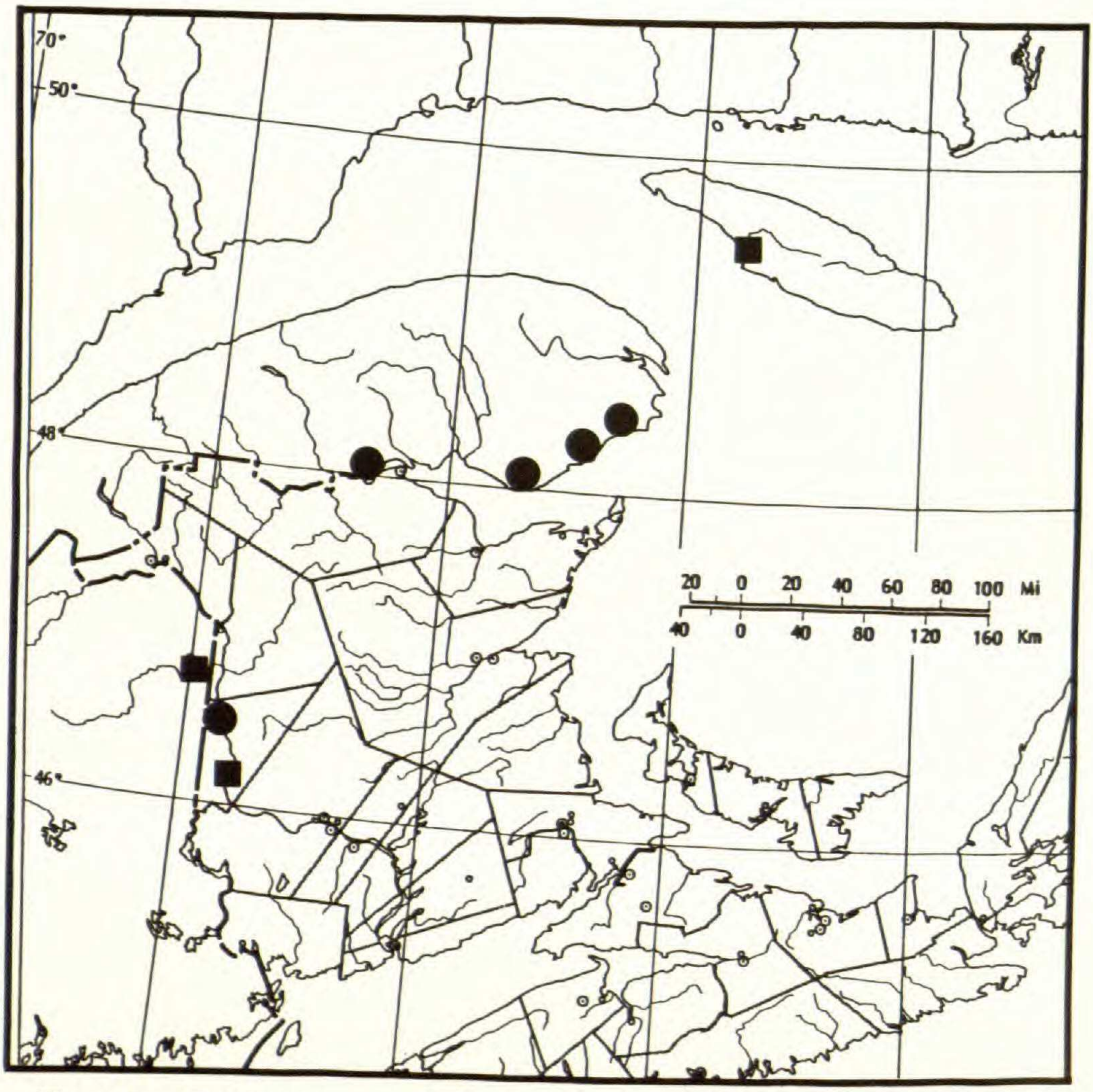

Figure 1. Distribution map of *Aster anticostensis* Fernald. Dots represent populations re-located in 1988; squares represent historical records.

as *Rhus radicans* L., *Aster cordifolius* L. and *Asarum canadense* L., are found in this area (Raymond, 1950). Although *A. anticostensis* occurs in a relatively temperate zone compared to the entire Gaspé Peninsula, the plant grows only on river strands, an environment with subarctic elements contrasting with the surrounding forest. Other plants that may be found there include: *Allium schoenoprasum* L., *Anemone multifida* Poiret, *Oxytropis campestris* (L.) DC. var. *johannensis* Fernald and *Tanacetum bipinnatum* (L.) Shultz-Bip ssp. *huronense* (Nutt.) Breitung. *Aster anticostensis* grows along rapid-flowing rivers, on the geolittoral zone (Figures 2 and 3). There is rarely more than a 3% slope. The soil is usually calcareous and coarsely sandy or gravelly in texture. *Aster anticostensis* was not found in areas where the substrate was

Figure 2. Habitat of *Aster anticostensis* along the St. John River in Somerville, New Brunswick; one clone is indicated by the arrow.

Figure 3. Habitat of *Aster anticostensis* along the Ristigouche River, in Matapédia-ouest, Québec; arrows indicate lower and upper limits of the large population on the geolittoral strand.

different (acidic or sandy) as was the case on two Gaspé rivers investigated, the Port-Daniel and Grand-Pabos. Table 2 summarizes the data collected in the summer of 1988 for the populations that were re-located.

It appears that erosion caused by ice and high water in the spring maintains populations. Gawler and Waller (1987) reached a similar conclusion for *Pedicularis furbishiae* S. Watson, a species found in the same area. Disturbance of loose soil, such as sand (as on the Grand-Pabos River) apparently prevents establishment of *A. anticostensis*. Substrate mobility can result in the burial of rhizomes or plantlets, or that type of soil may favor better-adapted species. The taxon is also absent from river estuaries, indicating that unlike *A. novi-belgii* it may be intolerant of a saline environment.

Aster anticostensis usually grows with species typically found along river banks or in humid environments, such as *Eupatorium maculatum* L., *Agrostis stolonifera* L. and *Apocynum cannabinum* L. It is often associated with plants that are specific to this type of habitat in the region, such as *Agropyron trachycaulum* (Link) Malte, *Dryas drummondii* Richards, *Hedysarum alpinum* L., *Muhlenbergia glomerata* (Willd.) Trinius, *Oxytropis campestris* var. *johannensis* and *Prunus pumila* L. var. *depressa* (Pursh) Bean.

POPULATION ECOLOGY

Four of the five extant populations contain several thousand individuals. The Somerville population is reduced to three isolated individuals. The Bonaventure River population is more heterogeneous than the other four because of hybridization with *A. novi-belgii* (Brouillet and Labrecque, 1987). No plantlets were observed during our August 1988 visit, but it must be remembered that asters are capable of flowering within their first year. Table 2 gives an estimate of the sizes of the populations relocated in 1988.

Flowering occurs from late July to September. Achenes were not observed during our visit in August as we were too early in the season; however, the species was able to invade locally disturbed habitat (such as roadsides) near established populations, indicating an ability of the species to perpetuate itself by seed.

Autecological data on *Aster anticostensis* are virtually non-existent. In our August 1988 visit, however, we recorded two neg-

ative interactions with other species. *Aster anticostensis* is apparently unable to hold its own against adventitious plants in an environment that is not regularly disturbed. In the Somerville population, the three individuals were practically buried among a multitude of weeds such as *Phalaris arundinacea* L., *Arctium lappa* L., *Melilotus alba* Desr. and *Trifolium* spp. When *Aster anticostensis* grows with *Aster cordifolius, A. ciliolatus* Lindley *in* DC., and especially *A. novi-belgii,* hybrids may be produced. It is interesting to note that *A. anticostensis* and *A. novi-belgii* generally do not grow in the same area. Human disturbances may, however, favor production of hybrids (as on the Bonaventure River) which are morphologically and cytologically intermediate between the two parents (Brouillet and Labrecque, 1987). Their presence on a large scale may eventually interfere with the genetic integrity of *A. anticostensis* populations.

THREATS TO SURVIVAL

The main threats to survival of populations of *Aster anticostensis* come from disruption of river banks as a result of human activity and from regulation of water flows and levels due to dam construction.

Two sites were disturbed by human activities. At the Bonaventure River site, we observed a fair amount of traffic by four-wheel-drive vehicles. The approaches to the bridge, in particular, have been subjected to considerable compaction by heavy equipment and were rendered bare of all vegetation. In addition, cottages are being built along the river, and the riverside forest is being cut. Since our visits of 1981 and August 1985, the site has been seriously degraded, and several clones of *Aster anticostensis* that existed then have since been destroyed. Theoretically, none of these activities are allowed, but no control appears to be exerted. These disruptions may have allowed *A. novi-belgii* to infiltrate the *A. anticostensis* population, leading to the production of hybrids.

There are similar, but less serious signs of disruption at the Grande Rivière site. The main problem there is passage of all-terrain vehicles, particularly near the new pumping station; construction of this station rendered access to the strands easier. Development projects along rivers in the area are certain to harm *Aster anticostensis* populations. While other sites in Quebec do

not seem to be under threat in the short term, their existence must be made known to competent authorities to prevent eventual disruptions.

The success of populations of *Aster anticostensis* seems to depend on the cyclical disturbances caused by springtime floods. When there is little or no rise in the water level, shrub cover or *Phalaris arundinacea* takes over the habitat and pioneer species such as *A. anticostensis* may be crowded out.

This phenomenon was observed on the Saint John River, N.B., where several dams regulate the river's water level, especially on its lower course. The dams are located at Grand Falls, Beechwood and Mactaquac (H. Hinds, pers. comm., 1988). The reservoir level of the Mactaquac dam has recently (1988) been raised from 130 to 133 meters, possibly affecting the only re-localized locality of *Aster anticostensis* in New Brunswick. The only cyclical disturbances that now occur in this area are due to the drawdown of surplus water in the spring. According to Harold Hinds, this artificial phenomenon helps to preserve the habitat of several riparian species. At the Somerville site, however, the banks have a much denser vegetative cover than the Quebec sites. Most of the dominant species are aggressive weeds, and there are few *A. anticostensis* individuals left, more or less suffocated by the adventives. As with *Pedicularis furbishiae,* dams appear to break the equilibrium of cyclical disturbances that is needed to maintain the habitat (Gawler and Waller, 1987).

At the present time, the Quebec sites are not affected by this problem. It is possible that the Fort Fairfield, Maine, site was destroyed by dam construction, although our visit at that site was too brief to ascertain the status of the population with any confidence. A dam would either destroy or at least seriously affect populations of *A. anticostensis* by eliminating the disturbance cycle.

TAXONOMY

Until recently *Aster anticostensis* was a poorly understood taxon known solely from the type specimen (Fernald, 1915, 1950; Figure 4). After examination of the type of *A. anticostensis,* it was concluded that this taxon is identical to *A. gaspensis* Marie-Victorin, described in 1932 (Figure 5). The name *A. anticostensis* thus has priority. A discussion of pertinent taxonomic literature concern-

Figure 4. Type of *Aster anticostensis* Fernald (GH).
Figure 5. Type of *Aster gaspensis* Marie-Victorin (MT).

ing *A. anticostensis* is given in Brouillet and Labrecque (1987). The exact nomenclature of the species is:

Aster anticostensis Fernald, Rhodora 17: 16–17, 1915. TYPE: "Québec, Anticosti, Jupiter River; River banks and grassy slopes," 22/07/1880, *J. Macoun no. 6* (as *A. paniculatus*) (HOLOTYPE, GH!).

A. gaspensis Marie-Victorin, Contr. Lab. Bot. Univ. Montréal 20: 3, 1932. TYPE: "Québec, sur les bords de la rivière Bonaventure, près du pont à environ 8 milles de l'embrouchure," 31/07/1931, *Marie-Victorin, Rolland-Germain & E. Jacques 37742* (HOLOTYPE, MT!).

A. gaspensis f. *albiflora* Marie-Victorin, Naturaliste Canadien 71: 209, 1944. TYPE: "Platières caillouteuses vers le hutième mille," *Marie-Victorin, Boivin, Raymond & Kucyniak 4035* (HOLOTYPE, MT!).

A. hesperius Gray var. *gaspensis* (Vict.) Boivin, Phytologia 23: 34, 1972.

A. hesperius Gray var. *gaspensis* (Vict.) Boivin f. *albiflora* (Vict.) Boivin, Phytologia 23: 35, 1972.

Aster anticostensis may be mistaken for *A. novi-belgii, A. borealis* and *A.* "*longifolius*" (*sensu* Semple and Heard, 1987). The latter is a still poorly known taxon found mainly in northern

Ontario and Quebec, south to Wisconsin (Semple and Heard, 1987; Semple et al., 1983). Although they are allopatric, *A. anticostensis* and *A.* "*longifolius*" share the same number of chromosomes ($2n = 80$ and 64). However, they may be distinguished by their leaves (coriaceous in the case of *A. anticostensis,* thinner in *A.* "*longifolius*"); the shape of the inflorescence (panicle long and narrow in *A. anticostensis,* more open in *A.* "*longifolius*"); and the habitat of each (humid depressions in the case of *A.* "*longifolius*," whereas *A. anticostensis* favors calcareous upper beaches). The relationships of *A.* "*longifolius*" remain to be established.

The species has not been described completely before. A description is thus provided here. Diagnostic characters are emphasized.

Perennial, propagating by *long stoloniferous rhizomes forming loose clones; stems* 25–75 cm tall, 2–4 mm in diameter, *stiff, erect,* grooved, puberulent along the lines of decurrence of the leaves, especially towards apex, stem branches ramified toward the top; *the upper lateral branches strongly ascending; leaves sessile, linear or linear-lanceolate, coriaceous,* 9–16 cm long, 5–18 mm wide, *ascending,* slightly narrower and clasping at the base, the apices acute, *entire to subentire,* with midveins prominent beneath; margins scabrous; rameal leaves reduced, 8–50 mm long, 1.5–5 mm wide; *capitulescence* paniculiform, *loose, elongate, consisting of* 11–51 *large, single heads at the ends of the primary and secondary branches*; peduncles long, 8–57 mm; heads with involucres 6–10 mm long; outer involucral bracts 3.3–5.9 mm long, 0.8–1.2 mm wide; inner 4.8–7.0 mm long, 0.9–1.1 mm wide; involucral bracts foliaceous, in 2 or 3 unequal series; rays 25–44, 9.5–20 mm long, pale purple, lilac or sometimes white; disc florets 29–52, yellow becoming reddish with age, corolla lobes erect, comprising 15–20% of the limb; pappus bristles as long or slightly longer than corolla; cypselas sparsely puberulent, mostly on the ribs, 1–1.5 mm long; chromosome number: $2n = 80$.

The following key distinguishes *Aster anticostensis* from related taxa.

1. Plant slender; rhizomes filiform, less than 2 mm in diameter; leaves linear, recurved at the margins, sessile, non-clasping; large but few heads (often monocephalous) on very slender peduncles ..... *A. borealis*

1. Plant robust; rhizomes thick, more than 2 mm in diameter; leaves different; plant usually not monocephalous 2
   2. Leaves oblanceolate, slightly fleshy, clasping base; capitulescence highly branched, numerous heads on short (usually less than 3 cm) peduncles .....*A. novi-belgii*
   2. Leaves linear-lanceolate, little or not narrowing at the base, sessile or almost sessile; capitulescence paniculiform, open, heads borne on long (usually more than 3 cm) peduncles 3
      3. Leaves arched, coriaceous, rigid, persisting; capitulescence made of strongly ascending branches .....
      .....*A. anticostensis*
      3. Leaves slightly fleshy, not rigid, deciduous at the base at anthesis; capitulescence branches not strongly ascending ..... *A.* "*longifolius*"

STATUS

Aster anticostensis is not included in the lists of rare plants of Québec (Bouchard et al., 1983), New Brunswick (Hinds, 1985), or Maine (Dibble et al., 1989). Since *A. anticostensis* populations are few in number and have a limited range of distribution, we suggest giving the taxon a "threatened" status, with a Nature Conservancy ranking of G2 for the global range, N2 for Canada, and S2 for the Province of Québec. However, the situation is different in New Brunswick where, as long as no further populations are located, the species must be considered as "endangered," with an S1 ranking. In Maine, where the taxon was last collected in 1901, the status "historically present" must be given.

The species must be looked for in its critical habitat, particularly in New Brunswick and Maine, where its survival is precarious, and most carefully searched for along the St. John and Aroostook Rivers where it was known historically. Similarly, searches should be made on Anticosti Island and along rivers of the Baie des Chaleurs area (Québec and New Brunswick). Extant populations should be monitored, and their ecology and resilience investigated.

SPECIMENS EXAMINED. [The list does not include those specimens cited under *Aster gaspensis* by Brouillet and Labrecque (1987).]

CANADA. **Québec.** Bonaventure Co.: Bonaventure River, near the bridge of the St. Elzéar road, *J. Labrecque, L. Brouillet & D. Whetstone 99,* 23/08/1988 (MT); Petit-Pabos River, eroded bank at about 3 km from the mouth, *JL, LB & DW 184,* 25/08/1988 (MT). Gaspé-est Co.: Grande-Rivière River, calcareous bank about 5 km from the mouth, *JL, LB & DW 132, 162,* 24/08/1988 (MT). Matapédia Co.: Restigouche River, 4 km southwest of Matapédia, *JL, LB & DW 64,* 23/08/1988 (MT). **New Brunswick.** Carleton Co.: Somerville, about 1.6 km south of Hartland covered bridge on the St. John River, *JL, LB & DW 3,* 22/08/1988 (MT); *H. Hinds & S. Clayden 68,* 21/08/1977 (as *A. novi-belgii*) (UNB); Woodstock, gravelly flat along an island in the St. John River, *W. G. Dore & E. Gorham 45-880,* 28/07/1945 (as *A. foliaceus*) (DAO, MT).

U.S.A. **Maine**. Aroostook Co.: Fort Fairfield, gravelly bank of the Aroostook River, *E. F. Williams, B. L. Robinson & M. L. Fernald, s.n.,* 15/08/1901 (as *A. junceus*) (ISC, GH, MT, WIS); *J. R. Churchill, s.n.,* 11 & 16/08/1901 (as *A. junceus*) (MO).

ACKNOWLEDGMENTS

The help of Dr. David Whetstone during our fieldwork of August 1988 is gratefully acknowledged. This work was supported by grants from the Natural Sciences and Engineering Research Council of Canada, and by World Wildlife Fund-Canada through the COSEWIC program.

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